Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 93 (2013) 247 – 251

Procedia
Social and Behavioral Sciences

3rd World Conference on Learning, Teaching and Educational Leadership (WCLTA-2012)

On Turkish candidate science teachers' pre-existing ideas about some basic astronomy concepts

Mehmet Altan Kurnaz[a], * , Nezihe Gökçen Gültekin[b], Ümmü Gülsüm İyibil[c]

[a] *Faculty of Education, Kastamonu University, Kastamonu-Turkey*
[b] *Graduate School of Natural and Applied Science, Kastamonu University, Kastamonu-Turkey*
[c] *Graduate School of Natural and Applied Science, Karadeniz Technical University, , Trabzon-Turkey*

Abstract

Determining pre-existing ideas is an important strategy to construct learning environment and improve learning. This study is designed to reveal Turkish candidate science teachers' pre-existing ideas about some basic astronomy concepts. In fact, this study is a continuation of a study carried on pupils from different grades at secondary and high schools. In this regard, the study is remarkable to allow a comparison between perceptions of the candidate teachers and pupils. The participants of the study were 118 candidate science teachers from two universities. A data meaning-analysis table was used as the data collection tool. The gathered data was analyzed through classifying, which was shown in tables. The findings have showed that the candidate teachers did not have adequate knowledge to match the given astronomy concepts with their characteristics. In addition, the findings also indicated that consistency of candidate teachers' responses to concepts and examples of these concepts were not sufficient. Based on the findings, some suggestions were made to curriculum developers, researchers and teachers.

© 2013 The Authors. Published by Elsevier Ltd. Open access under CC BY-NC-ND license.
Selection and peer review under responsibility of Prof. Dr. Ferhan Odabaşı

Keywords: basic astronomy concepts; meaning-analysis table; candidate science teachers.

1. Introduction

The efforts to be able to understand the World, the Universe and the Nature have provided for the deep connections between astronomy and sciences. This deep relationship and the intense interest of individuals towards astronomy have led researchers to determine students' understanding of basic astronomy concepts. It is interesting that studies regarding students' understanding of basic astronomy concepts have intensified from the beginning of the 1970s (Trumper, 2003, 2006). Studies in Turkey though have increased especially in the last

* Mehmet Altan KURNAZ. Tel.: +90-366-214-2312.
E-mail address: makurnaz@kastamonu.edu.tr

1877-0428 © 2013 The Authors. Published by Elsevier Ltd. Open access under CC BY-NC-ND license.
Selection and peer review under responsibility of Prof. Dr. Ferhan Odabaşı
doi:10.1016/j.sbspro.2013.09.184

twenty years. It is significant that studies reflecting the effects of the recently constructed education programmes have increased. In this sense, it can be said that the obtained results may lead to the rearrangement of education programmes, help design learning environments, and shed light on new researches. However, another significant issue is the competencies and practices of teachers, who are the practitioners of new education programmes. From this point, the competencies of candidate teachers can be interrogated. In this study, it has been aimed to question the competencies of candidate teachers, who will teach the basic astronomy concepts regarding the topic.

Among the studies regarding the competencies of Turkish candidate teachers are Unsal et. al (2001), Kalkan & Kıroglu (2007), Emrahoglu & Ozturk (2009), Turkoglu et. al (2009), and Iyibil and Saglam Arslan (2010). In these studies, it has been stated that candidate teachers have wrong understanding of the basic astronomy concepts, but studies which consider the relationships/differences regarding candidate teachers' understanding of cross-concepts are needed. A parallel study underpinning the mentioned point of view has been conducted by Kurnaz & Degermenci on primary and secondary education students (2011).The researchers have found out that the students at all grades are not able to match the concept with its characteristic and construct different understanding for the concept and its example.

This study is a continuation of the mentioned study by Kurnaz and Degermenci (2011) and aims to examine candidate science teachers' understanding of some basic astronomy concepts. The findings are thought to facilitate to compare candidate teachers' understanding with students' understanding within the same framework.

2. Method

In this study, survey method has been used. The study has been conducted with candidate science teachers studying at Faculty of Education in two different universities in the West and East Black Sea regions. The study group consists of 118 candidate science teachers. The data has been collected through a data meaning-analysis table developed by Kurnaz & Degermenci (2011). In one part of the table, some celestial bodies (planet, star, satellite, and galaxy, the World, the Sun and the Moon) have been placed while on the other part, some characteristics of these celestial bodies have been placed. In the analysis stage, it has been examined whether candidate teachers respond consistently or not. In this part, the responses to the items 'not a planet, not a star, and a set of celestial bodies' have been evaluated. Here, the candidate teachers marking 'not a star' for star item have not been included because they are thought to have marked randomly. Next, the matching for celestial bodies and their characteristics, and the responses to celestial body and its example (star-The Sun, planet-the World, satellite-the Moon) have been examined comparatively. The obtained findings have been shown in the tables.

3. Findings

The obtained findings regarding the matching of celestial bodies and their characteristics done by candidate science teachers have been shown in Table 1. As it is seen in Table 1, almost all candidate teachers have stated that the World moves, half of them have stated that star, satellite and the Sun move, and more than half of them have stated that the Moon moves. A small number of participants have stated that galaxy moves. A small number of the candidate teachers have stated that planet, satellite, galaxy and the World shine while almost half of them have expressed that the Moon shines. For the Sun and star, almost all of them have stated that they shine. According to the table, a great majority of the candidate teachers think that star, satellite, galaxy, the Sun and the Moon do not have atmosphere. Almost all of the candidate teachers have stated that the World does not have an orbit and half of them have stated that satellite, planet, the Sun, and the Moon do not have orbits. A small number of them have stated that star and galaxy do not have orbits. Almost half of the candidate teachers have stated that satellite and the galaxy are celestial bodies whereas majority of them have stated that planet, star, the World, the Sun, and the Moon are celestial bodies. Almost half of the students have stated that galaxies are a set of celestial bodies. For the other concepts, almost all the students have stated that they are not celestial bodies. For the Sun,

almost all of the candidates have marked it as a source of light. Almost half of them have stated that star is a source of light while a small number of them have stated that the Moon is a source of light. The students have marked that satellite; galaxy and the Earth are not sources of light. Majority of the students have marked that the Moon reflects light. For planet, satellite, galaxy, the World and the Sun, a very small number of them have marked 'It reflects light', and almost half of them have stated that star reflects light. Majority of the candidates have expressed that the World is not a star, and almost half of them have stated that planet, satellite, galaxy, and the Moon are not stars. Minority of them have stated that the Sun is not a star. For star, satellite, and the Sun, almost half of them have marked 'it is not a planet' while some of them have marked 'it is not a star' for galaxy, the World, and the Sun. Most of the students have stated that the Moon and the Sun can be seen by naked eye, and some of them have stated that planet, satellite, galaxy and the World can be seen by naked eye. Almost all of the candidate teachers have stated that the World revolves around itself and some of them have stated that the Moon revolves around itself, and some of them have stated planet, star, satellite, galaxy and the Sun revolve around themselves. The majority of the candidate teachers have marked that the World revolves around the Moon, and half of them have stated that satellite revolves around other celestial bodies. Some of them have stated that planet; star, galaxy, and the Sun revolve around other celestial bodies.

Table 1. The matching done for celestial bodies and their characteristics

Characteristic	Planet		Star		Satellite		Galaxy		World		Sun		Moon	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
It moves.	87	74	70	59	71	59	38	32	115	97	62	53	90	76
It shines.	13	11	95	81	10	8	11	9	9	8	109	92	64	54
It might have an atmosphere.	41	35	8	7	14	12	8	7	109	92	15	13	19	16
It has an orbit.	73	62	25	21	50	42	12	10	104	88	60	51	71	60
It is a celestial body.	76	64	84	71	56	47	51	43	68	58	71	60	76	64
It is a set of celestial bodies.	16	14	14	12	10	8	55	47	1	1	2	2	2	2
It is a source of light.	1	1	50	42	-	-	-	-	-	-	116	98	22	19
It reflects light.	14	12	48	41	14	12	2	2	16	14	22	19	83	70
It is not a star.	55	47	-	-	67	57	47	40	78	66	29	25	55	47
It is not a planet.	-	-	52	44	59	50	40	34	1	1	64	54	43	36
It is seen by naked eye.	17	14	87	74	22	19	3	3	38	32	85	72	99	84
It revolves around itself.	37	31	15	13	18	15	7	6	113	96	41	35	49	42
It revolves around other celestial bodies.	43	36	20	17	50	42	6	5	86	73	20	17	86	73

The candidate teachers are expected to respond consistently for planet, star, and satellite, the World, the Sun and, the Moon. In this study, the candidate teachers' inconsistent responses to planet-the World, star-the Sun, satellite-the Moon have been examined. In this study, the incompatibilities greater than 20 %, between two concepts have been taken into consideration. The percentages of the responses to planet and the World have been presented in Table 2.

Table 2. The comparison of the responses to planet and the World

Characteristic	Planet (%)	The World (%)	Difference (%)
It revolves around itself.	31	96	65
It might have an atmosphere.	35	92	57
It revolves around other celestial bodies.	36	73	37
It has an orbit.	62	88	26
It moves.	74	97	23

Table 2 shows that the candidate teachers develop different understandings for planet and the World. It can be said that the candidates have different understandings regarding the fact that the relevant celestial bodies revolve around themselves and have atmospheres. It can also be pointed out that the candidates have distinct understandings of the fact that planet and the World revolve around other celestial bodies, have orbit, and move. The responses to star and the Sun have been shown in Table 3.

Table 3. The comparison of the responses to star and the Sun

Characteristic	Star (%)	Sun (%)	Difference (%)
It is a source of light.	42	98	56
It has an orbit.	21	51	30
It is not a star.	-	25	25
It revolves around itself.	13	35	22
It reflects light	41	19	22

Table 3 shows that there is a meaningful difference in the candidate teachers' responses to star and the Sun. There is also a clear difference about the given celestial bodies' being sources of light. Besides, there is also meaningful difference in topics having orbit, being a star, revolving around itself, and reflecting light. The candidate teachers' responses to satellite and the Moon have been shown in Table 4.

Table 4. The comparison of the responses to satellite and the Moon

Characteristic	Satellite (%)	The Moon (%)	Difference (%)
It is seen by naked eye.	19	84	65
It reflects light.	12	70	58
It shines.	8	54	46
It revolves around other celestial bodies.	42	73	31
It revolves around itself.	15	42	27

It is clear from Table 4 that there is a clear difference of understanding between the responses to satellite and the Moon. The responses to seeing satellite and the Moon by naked eye, reflecting light, and shining do not overlap. Moreover, it can also be asserted that there is a different understanding for the items' revolving around themselves and other celestial bodies'.

4. Discussion and conclusion

As stated before, this study is a continuation of another study conducted with primary and secondary education students. The aim of the study is to determine candidate science teachers' understanding of concepts such as planet, star, satellite, galaxy, the World, the Sun and, the Moon. It is thought that a direct comparison between Turkish candidate science teachers and primary and secondary education students will be provided. It is also assumed that results of such a study will shed light on studies in different countries.

The findings point out that the candidate teachers are not able to match the concepts and their definitions correctly (Table 1). The findings show that candidate teachers cannot understand the characteristics of the given concepts correctly and confuse them with the characteristics of similar concepts. The findings also show that candidates develop different understandings for the World-planet, the Moon-satellite, and the Sun-star concepts (Tables 2 - 4). According to Ayas (2005) and Kurnaz (2011) knowing only the definition of the concepts does not mean that the candidate teachers have learnt well. According to researchers, being able to express all aspects of the concept and distinguish them from other related concepts show the existence of learning. When the findings are evaluated within this frame, it is clear that candidate teachers do not possess sufficient understanding regarding the related concepts. The obtained results show parallelism with the studies of Iyibil (2010), Iyibil and Saglam Arslan (2010) and Emrahoglu and Ozturk (2009). The findings overlap with the results of Kurnaz and Degermenci (2011). It is meaningful that Turkish candidate science teachers have similar understanding deficiencies with primary and secondary education students. The source of primary and secondary school students' deficiencies may stem from learning environments designed by teachers with deficient and/or wrong information. In this study, the obtained results are just determination of situations and it is suggested that further studies should be carried out. In the process of teaching the related concepts to teachers, it is suggested that arrangements revealing the similarities and differences between these concepts should be made. In this sense, data meaning-analysis tables are suggested to be used.

References

Emrahoglu, N., & Ozturk, A. (2009). Fen Bilgisi Öğretmen Adaylarının Astronomi Kavramlarını Anlama Seviyelerinin ve Kavram Yanılgılarının İncelenmesi Üzerine Boylamsal Bir Araştırma. *Ç.Ü. Sosyal Bilimler Enstitüsü Dergisi*, *18* (1), 165–180.

İyibil, Ü. (2010). *Farklı Programlarda Öğrenim Gören Öğretmen Adaylarının Temel Astronomi Kavramlarını Anlama Düzeylerinin ve İlgili Kavramlara Ait Zihinsel Modellerinin Analizi*, Yayınlanmamış Yüksek Lisans Tezi, KTÜ, Trabzon.

İyibil, Ü., & Sağlam Arslan, A. (2010). Fizik Öğretmen Adaylarının Yıldız Kavramına Dair Zihinsel Modelleri. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi (EFMED), 4* (2), 25-46.

Kalkan, H., & Kıroğlu, K. (2007). Science and Nonscience Students' Ideas about Basic Astronomy Concepts in Pre-service Training for Elemantary School Teachers. *Astronomy Education Review*, *6* (1), 15-24.

Kurnaz M. A. (2011). *Enerji Konusunda Model Tabanlı Öğrenme Yaklaşımına Göre Tasarlanan Öğrenme Ortamlarının Zihinsel Model Gelişimine Etkisi.* Yayınlanmamış Doktora Tezi, Karadeniz Teknik Üniversitesi, Trabzon, Türkiye.

Kurnaz, M. A., & Değermenci, A. (2011). Temel Astronomi Kavramlarına İlişkin Öğrenci Algılamalarının Sınıf Seviyelerine Göre Karşılaştırması. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*, *11* (22), 97 - 120.

Trumper, R. (2003). The Need for Change in Elementary School Teacher Training-a Cross-College Age Study of Future Teachers' Conceptions of Basic Astronomy Concepts. *Teaching and Teacher Education, 19*, 309–323.

Trumper, R. (2006). Teaching Future Teachers Basic Astronomy Concepts at a Time of Reform in Science Education. *Journal of Research in Science Teaching, 43*, 879-906.

Türkoğlu, O., Örnek, F., Gökdere, M., Suleymanoğlu, N., & Orbay, M. (2009). On pre-service science teachers' preexisting knowledge levels about basic astronomy concepts. *International Journal of Physical Sciences, 4* (11), 734-739.

Ünsal, Y., Güneş, B., & Ergin, İ. (2001). Yükseköğretim Öğrencilerinin Temel Astronomi Konularındaki Bilgi Düzeylerinin Tespitine Yönelik Bir Araştırma. *G.Ü. Gazi Eğitim Fakültesi Dergisi, 21* (3), 47-60.